TWO NEW SPECIES OF THE DROSOPHILA SUBGENUS PHOLADORIS AND A REDESCRIPTION OF DROSOPHILA HYPOCAUSTA OSTEN SACKEN

(DIPTERA, DROSOPHILIDAE)

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In the course of a study of seasonal fluctuations of *Drosophila* species in the Lebanon (Pipkin, 1952),[1] three new species belonging to the *victoria* group of the subgenus *Pholadoris* (*Drosophila*) were found. The first, *D. lebanonensis,* a geographical replacement of *D. victoria*, was described by Wheeler (1949). The purpose of the present paper is to describe the remaining two species, *D. pattersoni,* sp. nov., and *D. stonei,* sp. nov. A redescription of *D. hypocausta* Osten Sacken, of the *immigrans* group, subgenus *Drosophila* Fallén (*Drosophila*), from the Truk atoll, Eastern Caroline Islands, is also presented.

DESCRIPTION OF THE NEW SPECIES

Drosophila pattersoni, sp. nov.

(subgenus *Pholadoris*)

(Figs. 2, 6, 8, 10, 11, 12)

Male.—Arista with about 7 branches, two below in addition to the terminal fork. Antennae brown, the second and third joints being the same color. Face and front yellowish brown; ocellar triangle and orbits, brown. Frontal hairs in a rough V, the point lying anteriorly and hairs pointing medially; the bristle bearing area not shiny. A single prominent oral bristle, the slender second oral bristle about half as long as the first. Middle orbital about one-fourth the length of the other two; posterior orbital a little longer than the anterior orbital. Carina small, expanded below, not sulcate, bulbous. Palpi light tan with 3-4 prominent hairs. Checks yellowish, their width about one-sixth the greatest diameter of the eye, with about 4 prominent bristles at the lower angle of the cheek. Eyes reddish on emergence (Pl. 6-L 5),[2] darkening with age; pile short and dark.

Acrostichal hairs often in 6 rows, with an additional row on each side just anterior to the level of the anterior dorsocentral bristles; sometimes acrostichal hairs irregular and present in 7 or 8 rows. Four bristles in the prescutellar row, the median pair being enlarged to form prescutellar bristles extending one-third the greatest length of the scutellum. Anterior scutellars divergent. Three well developed sternopleurals, the middle one thin, about half the length of the posterior; sterno-index about .8. Halteres pale yellow. Mesonotum yellowish brown with a narrow pale gray medial stripe; pleurae dark grayish brown.

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[1]Collections made while the author was the recipient of a Rockefeller Foundation Grant, Division of Natural Sciences, from 1947-1950.

[2]Color determinations from *A Dictionary of Color* by Maerz and Paul (1930) were made for eye color on newly hatched flies and for testes color on flies 3 days old.

Legs yellowish brown, all parts of uniform shade. Apical bristles on 1st and 2nd tibiae; preapicals on all three.

Abdominal tergites shining black, the basal one somewhat less so and paler medially. Sternites pale gray, the yellow testes being faintly visible through the ventral body wall. Hypopygium retracted into abdomen, possessing the general characteristics of the *victoria* group described by Hsu (1949). Lobe-like process on the heel of the clasper prominent; primary teeth of clasper about 11. Four bristles on the upper part of the genital arch; numerous bristles on the lower part of the genital arch and on the anal plate; these bristles closely approximating in position and size those of *D. stonei*, sp. nov. (fig. 3).

Female.—Same as above except for genitalia differences and slight differences in abdominal coloration. First abdominal tergite yellowish medially, dark brown laterally. Broad shining black bands across the 2nd, 3rd, 4th, and 5th tergites, the black area narrowing laterally. Anterior, lateral, and very narrow posterior margins of all tergites yellowish. Circum-anal tergite yellow medially with black spots laterally, its anterior, posterior, and lateral margins being yellowish. Anal plates yellowish; ovipositor yellowish tan. Sternites pale gray.

Wings clear. Costal index about 2.3; 4th vein index, 2.4; 4c index, 1.3; 5x index, 2. Two bristles at the apex of the first costal section. Heavy hairs on the basal three-fifths of the third costal section.

Length, male body, 2.7 mm. (in live specimen); wings, 2.3 mm.

Length, female body, 2.8 mm.; wings, 2.5 mm.

Testes elliptical, bright yellow (Pl. 10-K 5). Ventral receptacle short, finger-like, bent once. Spermathecae with chitinized centers (fig. 10). Posterior malpighian tubes approximately two-thirds as long as anterior malpighian tubes, the common stalks of each about one-tenth their total length. Tips of anterior tubes free; those of posterior tubes apposed without the formation of a continuous lumen.

Physiological characters.—Recovers rapidly from anaesthetization with ether. Will breed in the dark.

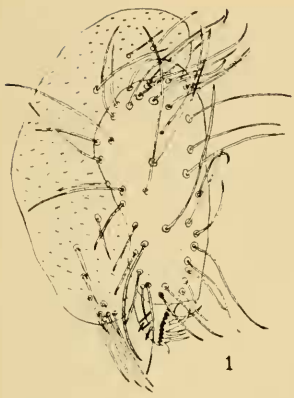
Eggs.—With from 3 to 8 filaments; 26% with 4; 48% with 5; and 15% with 6 filaments. Tips of filaments curly (fig. 8).

Larvae.—White in color; skip; very active; often escape plugged bottles unless these are capped with gauze.

Puparia.—Dull gold (Pl. 12-J 10). Each anterior spiracle with 6-9 branches, 52% having 8 branches. Stalk of anterior spiracle very short. Posterior spiracles closely apposed (fig. 6). Pupation usually in the paper in laboratory bottles, sometimes near the cotton plugs.

Chromosomes.—Larval brain preparations show males and females with one pair of large V's, 2 pairs medium-sized V's, and one pair rods (figs. 11 and 12). Salivary chromosomes with 3 long arms, 2 medium arms, 2 short arms, a pronounced chromocenter; one salivary gland smaller than the other.

Drosophila pattersoni, n. sp.: fig. 2, hypopygium; fig. 6, puparium; fig. 8, egg; fig. 10, spermatheca; fig. 11, chromosomes of larval brain of male; fig. 12, same, of female. *D. stonei*, n. sp.: fig. 3, hypopygium; fig. 4, internal reproductive tract of male; fig. 5, same, of female; fig. 7, egg; fig. 9, spermatheca; figs. 13-16, chromosomes of larval brain of male, female, female, and male, respectively. *D. hypocausta* O. S.; fig. 1, hypopygium; fig. 17, chromosomes of larval brain of male; fig. 18, chromosomes of oocyte of female.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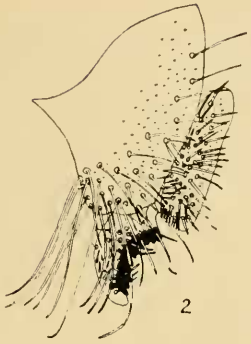
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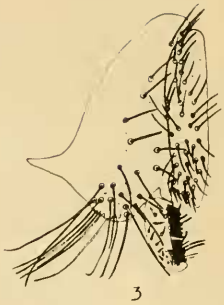
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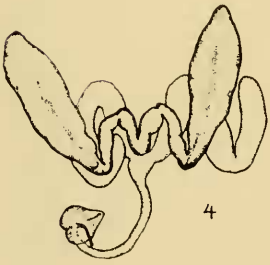
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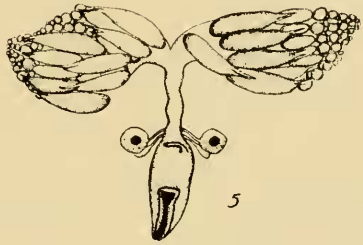
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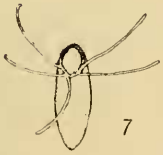
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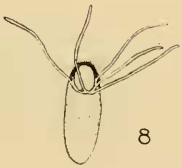
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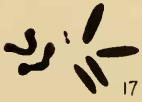
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Relationship.—Belongs to the *victoria* group of the subgenus *Pholadoris* with *D. victoria* Sturtevant, 1942, *D. nitens* Buzzati-Traverso, 1943; *D. lebanonensis* Wheeler, 1949, and *D. stonei*, sp. nov. *D. pattersoni* is the only yellowish member of this species group. Females of *D. pattersoni* crossed with males of *D. lebanonensis* produce slowly developing larvae and pupae which die at various stages of development, only rarely giving rise to a hybrid imago. The results of this cross are similar when males are chosen from *lebanonensis* strains of different regions; i.e., Beirut, Sofar, Ksara, or Ain Anub. The rare hybrids are of both sexes, small, squat, with minute bristles, wings frequently not fully expanded, posterior ocelli fused, ommatidia slightly disarranged; eye color dark as in *lebanonensis;* body color dark as in *lebanonensis* but with light area on posterior thorax and scutellum. *D. pattersoni* females crossed with *D. victoria* (Arizona strain) males less readily produce slowly developing larvae and pupae, more of the hybrids dying in the earlier larval stages, giving rise to a hybrid imago in only two instances. The two hybrid females were small and squat, with minute bristles, one wing crumpled, ommatidia not rough but splotched with dark red and lighter red; body dark with two light spots on the posterior thorax separated by a dark bridge reaching the scutellum.

D. pattersoni females and *D. stonei* males are poorly fertile, giving F_1 hybrids which are sterile *inter se,* but the F_1 *pattersoni/stonei* female hybrids are fertile with *D. pattersoni* males. Progeny from this back cross are fertile *inter se.* The F_1 *pattersoni/stonei* hybrids are slightly lighter than *D. stonei* in color, but they are much darker than their *pattersoni* parent.

Corresponding reciprocal crosses; i.e., females of *D. lebanonensis* with males of *D. pattersoni;* females of *D. stonei* with males of *D. pattersoni;* and females of *D. victoria* with males of D. pattersoni do not yield hybrid larvae. However, *pattersoni/stonei* hybrid females, proven sterile with their brothers, when recrossed with *D. lebanonensis* males, yielded larvae which died in the first and second stages.

Distribution.—Of 835 collections from six regions within 35 miles of Beirut, Lebanon, *D. pattersoni* was trapped only 3 times: 2 females were taken at Beirut on Sept. 5 and 6, 1948 and a single female was taken at Ksara in the Bekaa Valley on Sept. 12, 1948.

Types.—Holotype male and a series of paratype males and females, no. 2093.3, from the Beirut stock. These specimens as well as the type of the other species described in this article have bee placed in the *Drosophila* Type and Reference Collection of The University of Texas, Austin, Texas.

Drosophila stonei, sp. nov.

(subgenus *Pholadoris*)

(Figs. 3, 4, 5, 7, 9, 13-16)

Male.—Arista with about 7 branches, 2 below in addition to the terminal fork. Antennae black; face and front dark brown; ocellar triangle and orbits black.

Each orbit shows 3 prionose areas appearing whitish when viewed from certain angles: one anterior to the proclinate orbital, one between the proclinate orbital and the posterior reclinate orbital, and one anterior and medial to the inner vertical. Similar prionose areas present in related species of the *victoria* group but not prominent. Frontal hairs pointing anteriorly in a rough V. A single prominent oral bristle, the second oral bristle slender and about half the length of the first. Middle orbital about one-fourth the length of the anterior and posterior orbitals. Carina small, widely expanded below, bulbous, not sulcate. Palpi light tan, darker on distal ends, with 4 prominent hairs. Cheeks dark brown, their width about 1/6 the greatest diameter of the eyes. Four prominent bristles at the lower angle of the cheek. Eyes dark red on hatching (Pl. 7-L7), becoming wine color with age; short dark pile.

Acrostichal hairs in 6 obvious rows but usually an additional row on each side ending just anterior to the level of the anterior dorsocentrals. Four hairs in the prescutellar row, the median pair enlarged to form prescutellar bristles extending one-third the greatest length of the scutellum. Anterior scutellars divergent. Three well developed sternopleurals, the middle one thin and ¾ the length of the posterior; sterno-index about 0.8. Halteres yellow, browish at the base. Mesonotum and scutellum shining black without a pattern. Legs dark brown to yellow brown, darkest on femora. Apical bristles on 1st and 2nd tibiae; preapicals on all three.

Abdominal tergites black and shining; the first one being dark brown medially. Sternites dark gray. Hypopygium retracted into abdomen resulting in a blunt tip when viewed from above. Lobe-like process on the heel of the clasper prominent; clasper with about 13 primary teeth; 4 bristles on the upper part of the genital arch; numerous bristles on the lower part of the genital arch and on the anal plate (fig. 3).

Female.—Same as above except for genitalia differences and slight differences in abdominal coloration. Abdomen with shining dark brown bands, the medial region of the first tergite lighter brown. The lateral anterior edges of the 2nd, 3rd, 4th, and 5th tergites slightly but progressively yellowed. The circum-anal tergite yellow medially with black spots laterally, and yellow anterior and posterior margins. Sternites pale gray. Ovipositor light yellowish brown.

Wings clear. Costal index about 2.4; 4th vein index, 2.7; 4c index, 1.3; 5x index, 2. Two bristles at the apex of the first costal section; heavy hairs on the basal three-fifths of the third costal section.

Length, male body 2.6 mm. (in live specimen); wing, 2.4 mm.

Length, female, 2.8 mm.; wing, 2.6 mm.

Testes elliptical; burnt orange in color (Pl. 10-K 8) (fig. 4). Ventral receptacle short, finger-like, bent once in the middle (fig. 5); centers of spermathecae chitinized (fig. 9). Anterior malpighian tubes about twice as long as posterior tubes; the common stalks of each about 1/10 their total length; tips of anterior tubes free; those of posterior tubes apposed but without the formation of a continuous lumen.

Physiological characters.—Recovers rapidly from anaesthetization with ether. Requires light for breeding.

Eggs.—With from 2 to 8 filaments; 40% with 5 filaments; 23% with 6 filaments; 20% with 4 filaments. Tips of filaments curly (fig. 7).

Larvae.—White in color; skip. Very active; often escape laboratory bottles unless these are capped with gauze.

Puparia.—Dull gold in color (Pl. 12-J 10). Each spiracle with from 5 to 8 branches, with 70% having 6 branches; stalk of anterior spiracle very short; posterior spiracles closely apposed. Pupation usually in the paper inserted in food medium in laboratory bottles but sometimes near the cotton plug.

Chromosomes.—Larval brain preparations show males with 1 pair large V's; 1 pair large long-armed J's; 1 pair small V's; and a large V-shaped Y chromosome plus either a rod-shaped X or an X chromosome with the shape of a short-armed J (fig. 16). Some slides show a pericentric inversion in the first pair of large V's, resulting in 1 pair large short-armed J's; 1 pair large long-armed J's; 1 pair small V's, and a large V plus either a rod or a short-armed J-shaped X chromosome (fig. 13). Observed preparations of females show 1 pair large V's; 1 pair large long-armed J's, 1 pair small V's; and either 2 rod-shaped X chromosomes or 2 X-chromosomes with the shape of short-armed J's (figs. 15, 14). Some salivary female preparations show 3 long arms, 4 medium arms, and a very short arm; chromocenter pronounced; 2 salivary glands not noticeably different in size.

Relationship.—Belongs to the subgenus *Pholadoris,* closely related to *D. victoria, D. nitens, D. lebanonensis,* and *D. pattersoni,* sp. nov. Females of *D stonei* and males of *D. lebanonensis* are usually sterile, rarely give 1st and 2nd stage larvae which die at one of these stages. Females of *D. stonei* give no hybrid larvae with *D. victoria* or *D. pattersoni* males. Males of *D. stonei* are sterile with females of *D. lebanonensis* and *D. victoria,* but they yield hybrids with females of *D. pattersoni* (see *D. pattersoni* for discussion of these hybrids).

Distribution.—Of 835 collections from 6 regions within 35 miles of Beirut, Lebanon, *D. stonei* was trapped on six occasions at Sofar (from 1 to 3 individuals being taken each time) during July, August, and September, 1948; and twice at Ain Anub during July and August, 1948, respectively, 2 individuals being taken on each occasion.

Types.—Holotype male and a series of paratype males and females, No. 2093.2, have been placed in the *Drosophila* Type and Reference Collection of the University of Texas, Austin, Texas.

Drosophila hypocausta Osten Sacken

(subgenus Drosophila)

Osten Sacken, 1882; De Meijere, 1911.

Male.—Arista with about 10 branches, 4 below, in addition to the terminal fork. First and second points of the antennae browish-yellow; third joint sooty-brown laterally, yellowish-brown medially. Front yellowish tan, paler anteriorly; ocellar triangle, black. Small furrow from anterior ocellus to anterior boundary of front with 6-8 tiny hairs on each side this furrow, just posterior to the

bases of the antennae. Middle orbital a third as long as posterior orbital; half as long as anterior orbital. Second oral bristle more than half as long as first. Orbits yellowish and pollinose. Palpi sooty, with 2 prominent bristles. Carina broad, flattened on top, not sulcate; face yellowish brown above, shading into sooty brown on lower carina. Cheeks dark brown, their greatest width scarcely 1/7 the greatest diameter of the eyes. Eyes bright red; short light pile.

Acrostichal bristles in 8 rows; no presecutellars. Anterior scutellars convergent. Sterno-index .5. Mesonotum yellowish brown dorsally with narrow paler longitudinal stripes on each side along the dorsocentral bristles extending the length of the mesonotum; also a pale central line, incomplete medially. Scutellum yellowish brown; pleurae sooty brown to shining black, the darkened area extending dorsally on the mesonotum to the level of the notopleural and humeral bristles and posteriorly to the transverse suture; darkest areas along the sutures. Coxae and femora shining dark brown to black; tibiae dark brown medially, yellowish brown at the extremities; tarsae yellowish brown. Preapical bristles on all three tibiae; apical bristles on the first and second tibiae, that of the second tibia, very large. Nine short black bristles in a row on the lower apical part of the forefemora, more conspicuous in the female than in the male owing to the pale color of the femora in the former. Halteres yellow.

Abdominal tergites with black shining bands posteriorly, their anterior margins yellowish brown, the light area occupying about three-quarters the width of the 1st tergite and diminishing with successive tergites. The dark abdominal bands extend to the lateral margins of the tergites. Sternites sooty, becoming progressively darkened posteriorly. A darkening with age of all body parts occurs. Hypopygium consists of a horse-shoe shaped genital arch with about 9 bristles on the lower part, 3 bristles on the upper part; primary clasper with 9 short stout primary teeth; marginal bristles about 6 (fig. 1).

Female.—As above, aside from genital differences and the following important exceptions in body color: palpi yellowish brown; pleurae yellowish, darkened to brownish along the sutures. Coxae of first two pairs of legs dirty yellow; otherwise, legs yellowish. Brown replaces black of male in first 4 abdominal tergites, their anterior margins being yellow. Fifth tergite brown on posterior lateral border; yellow medially; circum-anal tergite yellow. Ovipositor golden.

Wings yellowish with slight clouding on the posterior cross vein; veins slightly darkened. Costal index about 3.6; fourth vein index about 1.1; 5x index, 1; and 4c index, .63. Apex of first costal section with 2 bristles, the dorsal one being stout and slightly longer than the thin ventral bristle. Third costal section with heavy hairs on its basal half.

Length, male body, 2.8 mm. (live specimen); wings 2.6 mm.

Length, female body, 3 mm.; wings, 2.8 mm.

Testes with 3 pale yellow proximal gyres and 4 and ½ burnt-orange mottled with yellow distal gyres; ejaculatory sac with 2 diverticulae, each about one half the length of the sac. Spermathecae large, spherical, pale, not strongly chitinized; about 15 coils to the ventral receptacle; ventral receptacle not coiled at base.

Eggs. With 2 filaments, each filament being split into about 3 curly branches, beginning at at point approximately 2/3 the length of the filament.

Puparia.—Transparent brownish orange. Each anterior spiracle with from 13 to 19 branches; horn index about 2.4.

Chromosomes.—Larval brain of males and females and oocytes with one pair large V's, 2 pairs rods, and a pair of dots (figs. 17 and 18). Salivary chromosomes with 3 arms of medium length, 1 long arm, and 1 very short arm.

Relationship.—Belongs to the *immigrans* group of the subgenus *Drosophila* Fallén. Reciprocal crosses with *D. spinofemora* Patterson and Wheeler, 1942, were sterile.

Distribution.—The type described from male specimens by Osten-Sacken (1882) was collected in the Phillipine Islands by Dr. Carl Semper. The sexual color dimorphism was described from specimens collected in Java by DeMeijere (1911). The present description is based upon a stock brought by the author from the Truk atoll, Eastern Caroline Islands (Pipkin, 1953). The species was searched for in daily collections at Koror, The Palau Islands during July and August, 1952, without success.

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